UNITED STATES PATENT AND TRADEMARK OFFICE

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EXAMINER
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ART UNIT	PAPER NUMBER
2193	

DATE MAILED: 09/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>15 June 2005</u>.

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-7,9-18,20-31 and 33-36</u> is/are pending in the application.

　　4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1-7,9-18,20-31 and 33-36</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

　　Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

　　Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

　　a) ☐ All　b) ☐ Some * c) ☐ None of:

　　　1. ☐ Certified copies of the priority documents have been received.

　　　2. ☐ Certified copies of the priority documents have been received in Application No. _____.

　　　3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

　　* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6/15/05</u>.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   This action is in response to remarks filed on 6/15/05.

2.   At Applicant's request claims 1-7, 9-18, 30-24, 26-31, 33-36 have been

amended, claims 9, 19 and 32 have been cancled. Claims 1-8, 10-18, 20-31 and 33-36

are pending in this case.

Response to Arguments

3.   **Applicant's arguments on pp. 11-13 regarding the USC 102(b) rejection of**

claims 1-11, 13-23 and 25-35 have been fully considered but they are not

persuasive.

In the first full paragraph on pg. 12, Applicant states:

> Since Gaboury's logic program is made up of conditions, rather than instructions, it
> has no meaningful control flow. In the absence of such a control flow, Gaboury
> cannot be taken to teach the step of deriving a set of next-state functions
> representing the control flow, as recited in claim 1.

Examiner respectfully disagrees. In col. 7, at lines 62-65 Gaboury states 'the transition

function f takes the current state S, and the current input ... and computes the ... the

next state' clearly disclosing a next state function as claimed.

In the paragraph bridging pp. 12 and 13, Applicant goes on to state:

> The Examiner identified the next-state functions recited in claim 1 with Gaboury's
> FSM ... Gaboury's FSM, however preserves the program variables V1, ..., Vn even
> in its completed (reduced) form (col. 8, lines 35-41, and see also Fig. 8). The fact
> that Gaboury adds in type variables (col. 7, lines 37-41, cited by the Examiner in
> reference to this claim step) just reinforces the conclusion that Gaboury does not
> abstract out any program variables from his FSM, in distinction to the requirement of
> claim 1.

Examiner respectfully disagrees. First, Examiner would like to clarify that the claimed

'next state functions' were mapped to Gaboury's 'transition function f' and not to the

FSM as a whole.

Further, Gaboury's variables V_1 ... V_n are created during the conversion to a FSM (col.

8, lines 24-26 'creating n new variables V_i') and are used to abstractly represent original

program variables (col. 8, lines 25-31 'new atomic formulae $V_i=t_{ji}$ are created'), further

supporting the Examiner's position that Gaboury discloses 'replacing the references to

program variables' as recited in claim 1.

Accordingly, the USC 102(b) rejection of claims 1, 13 and 25 are maintained. Further as

Applicant's arguments regarding dependent claims 2-12, 14-24 and 26-36 depend,

respectively, on the patentability of claims 1, 13 and 25 the rejections of claims 2-12,

14-24 and 26-36 are also maintained.

4.   Applicant's arguments on pg. 14 regarding the 35 USC 102(b) rejection of

claim 2 have been fully considered but they are not persuasive.

In the first paragraph on pg. 14 Applicant states:

> It can be seen plainly in this figure that the encode FSM makes no use whatsoever
> of the line numbers in Fig. 2 (Gaboury's "source code") or in Fig. 8 (the FSM itself),
> or of any other element that could be considered a "counter" extracted from the
> source code, as required by claim 2.

Examiner respectfully disagrees. Looking at col. 8, lines 15-24, 26-31 and 35-41 we see

that each next state function ('next-state transition function') is expressed in terms of a

number of 'atomic formulae $V_i=t_{ji}$'. These atomic formulae consist of 'j' terms for each

instruction ('clause') i=1-m, thereby disclosing next state functions ('next-state transition

function') expressed, at least in part, in terms of the program counter ('i').

Accordingly the rejection of claim 2 is maintained.

5.   Applicant's arguments on pg. 14 regarding the USC 102(b) rejection of

claim 5 have been fully considered but they are not persuasive.

In the last paragraph on pg. 14, Applicant states:

> As noted earlier, Gaboury's FSM preserves the program variables. The persistence
> of the program variables V1 and V2 can be seen in the "completed form" of
> Gaboury's "canonical FSM" that is show in his Fig. 8 (see col. 8, lines 43-45). In
> other words, Gaboury's FSM is dependent on the data values of the program
> variables.

As discussed above in relation to claims 1, 13 and 25, Gaboury does not persist

'program variables' V1 and V2 to the "completed form" because variables V1 and V2

are not variables in the original program.

Accordingly the rejection of claim 5 is maintained.

Claim Objections

6.   Applicant's amendments to claims 7, 19 and 31 are sufficient to overcome the 27

CFR 1.75(c) objections to those claims. Consequently the objections have been

withdrawn.

7.   **Claim 20 is objected to because of the following informalities:** Claim 20

currently depends from canceled claim 19. For the purposes of this examination claim

20 will be assumed to be dependent on claim 18. Appropriate correction is required.

Claim Rejections - 35 USC § 101

Applicant's amendments are sufficient to overcome the 35 USC 101 rejections of claims

1-12, which are consequently withdrawn.

Claim Rejections - 35 USC § 102

8.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public
> use or on sale in this country, more than one year prior to the date of application for patent in the United
> States.

9.   **Claims 1-11, 13-23 and 25-35 rejected under 35 U.S.C. 102(b) as being**

anticipated by US 5,481,717 to Gaboury.

Regarding Claims 1, 13 and 25: Gaboury discloses verifying software source code

that includes references to program variables, the method comprising: processing the

source code to derive a set of next-state functions representing control flow of the

source code (col. 7, lines 62-65 'transition function f'); replacing the references to the

program variables in the source code with non-deterministic choices in the next-state

functions (col. 7, lines 37-41 'types are ... the set of possible terms that variables can

take on'); restricting the next-state functions including the non-deterministic choices to

produce a finite-state model of the control flow (col. 8, lines 8-10 'Conversion of a logic

program to a canonical FSM form involves a number of steps which eliminate the

structure implicit in the notation'); and verifying the finite-state model to find an error in

the source code (col. 12, lines 42-43 'the equality between the first FMS and the second

FMS is determined').

Regarding Claims 2, 14 and 26: The rejection of claims 1, 13 and 25 are incorporated

respectively; further Gaboury discloses that processing the source code comprises

extracting a program counter from the source code (col. 11, lines 34-38 'Enumeration of

the states'), and expressing the next-state functions in terms of the program counter

(col. 11, lines 34-38 'of the state occurring in the transition function').

Regarding Claims 3, 15 and 27: The rejection of claims 2, 14 and 26 are incorporated

respectively; further Gaboury discloses that processing the source code further

comprises expressing the next-state functions with reference to a stack pointer

associated with a stack used in running the code (col. 9, lines 6-8 'a limit of three has

been placed on the number of elements that can be pushed onto the stack'), and

wherein replacing the program variables comprises eliminating substantially all the

references to the program variables from the next-state functions (col. 8, lines 25-30

'atomic formulae ... for each i=1...n'), leaving the next-state functions dependent on the

program counter (col. 8, lines 25-30 'for each i=1...n') and on the stack pointer (col. 8,

lines 25-31 'atomic formulae ... for each ... j=1...m').

Regarding Claims 4, 16, and 28: The rejection of claims 3, 15 and 27 are incorporated

respectively; further Gaboury discloses that restricting the next-state functions

comprises limiting the stack pointer to a value no greater than a predetermined

maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements

that can be pushed onto the stack').

Regarding Claims 5, 17, and 29: The rejection of claim 1, 13 and 15 are incorporated

respectively; further Gaboury discloses replacing the program variables comprises

eliminating the references to the program variables from the next-state functions, so that

the finite-state model is substantially independent of data values of the program

variables (col. 8, lines 25-30 'atomic formulae ... for each $i=1...n$').

Regarding Claims 6, and 30: The rejection of claim 1, and 15 are incorporated

respectively; further Gaboury discloses processing the source code further comprises

expressing the next-state functions with reference to a stack used in running the code

(col. 8, lines 25-31 'atomic formulae ... for each ... $j=1...m$'), and wherein restricting the

next-state functions comprises limiting the stack to a depth no greater than a

predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the

number of elements that can be pushed onto the stack').

Regarding Claims 7, and 31: The rejection of claims 6 and 30 are incorporated,

respectively; further Gaboury discloses expressing the next-state functions comprises

expressing the next-state functions in terms of a stack pointer associated with the stack

(col. 8, lines 25-31 'atomic formulae ... for each ... $j=1...m$'), and wherein limiting the

stack comprises limiting the stack pointer to a value no greater than the predetermined

maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements

that can be pushed onto the stack'). Further Gaboury discloses expressing the next-

state functions in terms of the stack pointer comprises incrementing the stack pointer in

response to a function call in the source code (col. 6, lines 2-6 'pushed on the stack

during a push operation'), up to the predetermined maximum (col. 9, lines 6-8 'a limit of

three has been placed on the number of elements that can be pushed onto the stack'),

and decrementing the stack pointer when the function returns (col. 6, lines 2-6 'the

element popped').

Regarding Claims 9, 21 and 33: The rejection of claim 1, 13 and 15 are incorporated

respectively; further Gaboury discloses verifying the finite-state model comprises

checking the finite-state model against a specification using a model checker (col. 12,

lines 42-43 'the equality between the first FMS and the second FMS is determined').

Regarding Claims 10, 22 and 34: The rejection of claim 9, 21 and 33 are incorporated

respectively; further Gaboury discloses restricting the next-state functions comprises

automatically producing the model from the source code in a form suitable for

processing by the model checker (col. 2, lines 50-55 'FSMs which are suitable for

verification may be obtained'), substantially without human intervention in deriving and

restricting the next-state functions or in replacing the references (col. 3, lines 1-3

'eliminating the need for the user to determine the data types of the program').

Regarding Claims 11, 23 and 35: The rejection of claim 10, 22 and 34 are

incorporated respectively; further Gaboury discloses checking the finite state model

comprises checking the model against one or more formulas expressed in terms of

temporal logic (col. 4, line 18 'compares two FMSs').

Regarding Claim 18: The rejection of claim 13 is incorporated; further Gaboury

discloses processing the source code further comprises expressing the next-state

functions with reference to a stack used in running the code (col. 8, lines 25-31 'atomic

formulae ... for each ... j=1...m'), and wherein restricting the next-state functions

comprises limiting the stack to a depth no greater than a predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack'). Further Gaboury discloses expressing the next-state functions comprises expressing the next-state functions in terms of a stack pointer associated with the stack (col. 8, lines 25-31 'atomic formulae ... for each ... j=1...m'), and wherein limiting the stack comprises limiting the stack pointer to a value no greater than the predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack').

Regarding Claim 20: The rejection of claim 18 is incorporated; further Gaboury discloses expressing the next-state functions in terms of the stack pointer comprises incrementing the stack pointer in response to a function call in the source code (col. 6, lines 2-6 'pushed on the stack during a push operation'), up to the predetermined maximum (col. 9, lines 6-8 'a limit of three has been placed on the number of elements that can be pushed onto the stack'), and decrementing the stack pointer when the function returns (col. 6, lines 2-6 'the element popped').

Claim Rejections - 35 USC § 103

10.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11.   Claims 12, 24 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,481,717 to Gaboury in view of applicants admission of prior art techniques.

Regarding Claims 12, 24 and 36: The rejection of claim 11, 23 and 35 are incorporated respectively; further Gaboury does not disclose the use of counter-examples to indicate an error, but does disclose displaying the result of the model comparison to a user (col. 12, lines 42-45).

Applicant indicates, in the background disclosure of the instant application, that providing a counter-example was a common method in the art at the time of the invention for providing this information (pg. 1, line 27-pg. 2, line 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to display a counter-example, as taught by Applicant (pg. 1, line 27-pg. 2, line 1), to the user as disclosed in Gaboury (col. 12, lines 42-45) in order to provide a user a method of 'understanding and remedying the design defect' as noted in the instant application (pg. 2, lines 1-2).

Conclusion

12.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not
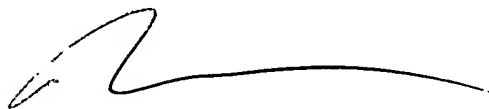
mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Jason Mitchell whose telephone number is (571) 272-

3728. The examiner can normally be reached on Monday-Thursday and alternate

Fridays 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Kakali Chaki can be reached on (571) 272-3719. The fax phone number for

the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

Jason Mitchell
8/25/05

ANIL KHATRI
PRIMARY EXAMINER